Device Requirements

High Level Conformance Requirements

Version 1.5.02

2017-02-20

NFC Forum™

[DEVREQS]

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1 Introduction

1.1 Objectives

This document outlines the set of functionalities and features that are required to be supported by NFC-Forum-compliant devices to ensure basic interoperability. Basic interoperability, as used in this document, refers to the specifications as listed in 1.4.

1.2 Purpose

The NFC Forum publishes a set of technical specifications for NFC technology. The purpose of this document is to define which high level features of the NFC Forum specifications must be implemented by a device to be eligible to receive the NFC Forum Certification Mark. These high level features are identified as requirements in this document.

1.3 Audience

This document is intended for use by manufacturers that want to implement the NFC Forum specifications in an NFC Forum Device.

1.4 Applicable Documents or References

The following documents contain provisions that are referenced in this specification. The latest revision of the below version (e.g., 0.0.X) including all published amendments applies unless a publication date is explicitly stated.

[ACTIVITY]	NFC Activity Technical Specification, Version 1.1, NFC Forum
[ANALOG]	NFC Analog Technical Specification, Version 2.0, NFC Forum
[ARCHITECTURE]	NFC Analog Technical Specification, Version 1.3, NFC Forum
[DIGITAL]	NFC Digital Protocol Technical Specification, Version 1.1, NFC Forum
[DTA]	Device Test Application Specification, Version 2.2, NFC Forum
[LLCP]	NFC Logical Link Control Protocol (LLCP) Technical Specification, Version 1.2, NFC Forum
[NDEF]	NFC Data Exchange Format (NDEF) Technical Specification, Version 1.0, NFC Forum

[RFC2119]	Key words for use in RFCs to Indicate Requirement Levels, RFC 2119, S. Bradner, March 1997, Internet Engineering Task Force
[RTD]	NFC Record Type Definition, Technical Specification, Version 1.0, NFC Forum
[SNEP]	NFC Simple NDEF Exchange Protocol (SNEP) Technical Specification, Version 1.0, NFC Forum
[T1TOP]	NFC Forum Type 1 Tag Operation Specification Version 1.2, NFC Forum
[T2TOP]	NFC Forum Type 2 Tag Operation Specification, Version 1.2, NFC Forum
[T3TOP]	NFC Forum Type 3 Tag Operation Specification, Technical Specification, Version 1.2, NFC Forum
[T4TOP]	NFC Forum Type 4 Tag Operation Specification, Technical Specification, Version 2.0, NFC Forum

In case the manufacturer decides to implement a device based on a newer version of the NFC Forum specifications, such devices remain eligible to receive NFC Forum Certification, assuming the manufacturer confirms functional compliance of the device to the specifications as listed above. This confirmation is given as part of the application for NFC Forum Certification for the device.

1.5 Administration

This document is maintained by the Near Field Communication Forum, Inc., located at:

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1.6 Name and Logo Usage

The Near Field Communication Forum's policy regarding the use of the trademarks *NFC Forum* and the NFC Forum logo is as follows:

- Any Supplier MAY claim compatibility with the authorized version of an NFC Forum specification, whether a member of the NFC Forum or not, provided that testing for certification was carried out as described in the Certification Policy, using validated test tools to execute the test cases in accordance with the test plan. The list of the authorized NFC Forum Test Specifications and the validated test tools are available on the Certification Program website at http://nfc-forum.org/our-work/compliance/certification-program/. In particular, Suppliers MUST NOT claim that a product has been "certified" unless that product has successfully passed the NFC Forum Certification Program.

- Permission to use the NFC Forum logo is automatically granted to designated members only as stipulated on the most recent Membership Benefits list during the period of time for which their membership dues are paid. The current list of Membership Benefits can be found at http://nfc-forum.org/about-us/join-the-forum/membership-overview/.

- Member's distributors and sales representatives MAY use the NFC Forum logo in promoting member's products sold under the name of the member.

- The logo SHALL be printed in black or in color as illustrated on the Logo Page that is available from the NFC Forum member website at http://www.nfc-forum.org/members/final_docs/NFC_Forum_logo_Kit.zip. The aspect ratio of the logo SHALL be maintained, but the size MAY vary. Nothing MAY be added to or deleted from the logo.

- Because the NFC Forum name is a trademark of the Near Field Communication Forum, the following statement SHALL be included in all published literature and advertising material in which the name or logo appears:

  NFC Forum and the NFC Forum logo are trademarks of the Near Field Communication Forum.

1.7 Intellectual Property

This document conforms to the Intellectual Property guidelines specified in the NFC Forum's *Intellectual Property Rights Policy* (http://nfc-forum.org/wp-content/uploads/2013/11/NFC-Forum-IPR-Policy.pdf), as outlined in the NFC Forum *Rules of Procedure* (http://nfc-forum.org/wp-content/uploads/2013/11/NFC-Forum-Rules-of-Procedure.pdf).

1.8 Special Word Usage

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

1.9   Abbreviations

Table 1: Abbreviations

Abbreviation	Description
APDU	Application Protocol Data Unit
DTA	Device Test Application
IEC	International Electrotechnical Commission
ICS	Implementation Conformance Statement
ISO	International Organization for Standardization
LLCP	Logical Link Control Protocol, as defined in [LLCP]
NDEF	NFC Data Exchange Format, as defined in [NDEF]
NFC	Near Field Communication
OSI	Open Systems Interconnection
P2P	NFC Forum Peer Mode based on Peer-to-Peer communication
RF	Radio Frequency

1.10   Glossary

Implementation Conformance Statement (ICS)

The ICS document contains a checklist of the capabilities supported by an NFC Forum implementation, and it is filled in by the supplier of an OSI implementation or system.

Initiator

A role of an NFC Forum Device reached when an NFC Forum Device in Poll Mode has gone through a number of Activities; in this mode the NFC Forum Device communicates using the NFC-DEP Protocol.

Interoperability Module

An interoperability module provides the basis for communication and interaction between components of the NFC Forum architecture.

Listen Mode

The mode of an NFC Forum Device where it receives Commands and send Responses, as defined in [ACTIVITY].

NFC Forum Card Emulation Mode

The mode used when an NFC Forum Device is using the part of the NFC Forum Protocol Stack that responds to Master/Slave Communication from a reader/writer terminal. When in NFC Forum Card Emulation Mode, the NFC Forum Device (emulating either an NFC Forum Tag or a contactless card) cannot start communication on its own. The Master/Slave Communication is initiated by a reader/writer terminal. The communication for this mode is abbreviated as CE.

NFC Forum Device

> A device capable of operating either in NFC Forum Peer Mode or in NFC Forum Reader/Writer Mode. It may also be capable of operating in NFC Forum Card Emulation Mode.NFC Forum Peer Mode.

NFC Forum Peer Mode

> The mode used when an NFC Forum Device is using the part of the NFC Forum Protocol Stack that enables Peer-to-Peer Communication with another NFC Forum Device using this same mode. The initiator starts the communication and the target responds to it. Both NFC Forum Devices have the capability to be either initiator or target. This mode uses the NFC-DEP Protocol as described in [DIGITAL]. The communication for this mode is abbreviated as P2P.

NFC Forum Reader/Writer Mode

> The mode used when an NFC Forum Device is using the part of the NFC Forum Protocol Stack that enables Master/Slave Communication with NFC Forum tags or contactless cards. The NFC Forum Device starts the Master/Slave Communication and sends commands to an NFC Forum tag or contactless card. The communication for this mode is abbreviated as RW.

NFC Forum Tag

> A product that is expected to behave in the same manner as a contactless tag, compatible to at least one of the mandated tag operation specifications supported by the NFC Forum Protocol Stack. (It implements the necessary protocols and supports NDEF so that an NFC Forum Device can communicate with and exchange data with the component).

NFC-A

> The technology based on the modulation scheme, bit level coding, and frame format as defined in [DIGITAL].

NFC-B

> The technology based on the modulation scheme, bit level coding, and frame format as defined in [DIGITAL].

NFC-DEP Protocol

> Half-duplex block transmission protocol as defined in [DIGITAL].

NFC-F

> The technology based on the modulation scheme, bit level coding, and frame format as defined in [DIGITAL].

Operating Volume

> The three-dimensional space as defined by the NFC Forum, in which an NFC Forum Device in Poll Mode can communicate with an NFC Forum Device in Listen Mode or has to be able to communicate with a responding device. Defined in [ANALOG].

Poll Mode

> Mode of an NFC Forum Device when it generates a carrier and polls for other devices. Defined in [ACTIVITY].

Record Type Definition (RTD)

An NFC Forum RTD defines NDEF payload data formats and their associated type names. The generic RTD guidelines are defined in [RTD].

Smart Card (SC)

A contactless tag or smart card based on one of the technologies (ISO/IEC_14443A, ISO/IEC_14443B, or JIS_X_6319-4) compatible with those defined by the NFC Forum (NFC-A, NFC-B, or NFC-F).

Target

Role of an NFC Forum Device, reached when the NFC Forum Device in Listen Mode has gone through a number of States in which the NFC Forum Device communicates using the NFC-DEP Protocol.

Technology

A group of transmission parameters defined by the NFC specifications that make up a complete communication protocol. These parameters include carrier frequency, bit rate, modulation scheme, bit level coding, frame format, protocol, and command set. All NFC Forum technologies use the same carrier frequency (13.56 MHz), but use a different modulation scheme, bit level coding, and frame format, and may share the protocol and command set.

Type X Tag

A contactless tag or smart card supporting NDEF, which can be accessed by a device implementing the tag operation specifications.

NOTE   "X" must be replaced by "1", "2", "3", "4", "4A", or "4B".

Type Y Tag Platform

The command set and underlying communication protocol of a Type Y Tag according to [DIGITAL].

NOTE   When used in a document, "Y" must be replaced by "3", "4A" or "4B".

2 Technology Definitions

In this document, the terms NFC-A, NFC-B, and NFC-F are used when referring to NFC Forum Devices. The terms ISO/IEC 14443A, ISO/IEC 14443B, and JIS X 6319-4 (also known as FeliCa) are used for the equivalent technologies that are not defined by the NFC Forum.

3   NFC Forum Devices

An NFC Forum Device consists of multiple interoperability modules defined in Section 4. This section defines the NFC Forum Device by mapping the defined interoperability modules to the NFC Forum Device implementation requirements. Finally, the interoperability between NFC Forum Devices is shown.

This document uses the following classifications:

- Mandatory (M) – for features that SHALL be implemented

- Optional (O) – for features that MAY be implemented

- Conditional (C) – for subfeatures that SHALL be implemented if the parent optional feature is implemented

The NFC Forum Device SHALL implement all modules that are marked as mandatory.

The NFC Forum Device MAY implement all modules that are marked as optional.

The NFC Forum Devices SHALL implement all modules that are marked as conditional for that type when the related condition set is true.

Table 2: NFC Forum Device to module mapping

NFC Forum Device	Reader/ Writer	Initiator	Target	Card Emulation Mode		
				Type 3 Tag Platform	Type 4A Tag Platform	Type 4B Tag Platform
NFC Forum Device	M	M	M	O	O	O

4 Interoperability Modules

For devices implementing NFC Forum specifications a number of interoperability modules have been defined. Each of these modules has an associated set of requirements.

4.1 Interoperability Modules Overview

This section lists and defines the modules building the basis for interoperability between NFC Forum Devices.

The defined interoperability modules are:

- Initiator
- Reader/Writer
- Target
- Card Emulation Modules
    - Type 3 Tag Platform
    - Type 4A Tag Platform
    - Type 4B Tag Platform

4.1.1 Initiator

The Initiator interoperability module covers the behavior of an NFC Forum Device implementing Poll Mode behavior in combination with the Initiator functionality as defined by [DIGITAL] and [ACTIVITY].

4.1.2 Reader/Writer

The Reader/Writer interoperability module covers the behavior of an NFC Forum Device implementing Poll Mode behavior in combination with the Reader/Writer functionality as defined by [DIGITAL] and [ACTIVITY]. This includes the ability the read/write to Type 1 Tag, Type 2 Tag, Type 3 Tag and Type 4A/B Tag.

4.1.3 Target

The Target interoperability module covers the behavior of an NFC Forum Device implementing Listen Mode behavior in combination with the Target functionality as defined by [DIGITAL] and [ACTIVITY].

4.1.4 Type 3 Tag Platform

The Type 3 Tag Platform interoperability module covers the behavior of an NFC Forum Device implementing Listen Mode behavior in combination with the Type 3 Tag Platform functionality as defined by [DIGITAL] and [ACTIVITY].

4.1.5 Type 4A Tag Platform

The Type 4A Tag Platform interoperability module covers the behavior of an NFC Forum Device implementing Listen Mode behavior in combination with the Type 4A Tag Platform functionality as defined by [DIGITAL] and [ACTIVITY].

4.1.6 Type 4B Tag Platform

The Type 4B Tag Platform interoperability module covers the behavior of an NFC Forum Device implementing Listen Mode behavior in combination with the Type 4B Tag Platform functionality as defined by [DIGITAL] and [ACTIVITY].

4.2 Interoperability of Modules

This section provides an overview of the interoperability between the defined modules. Interoperabilty is defined so that **two NFC Forum Devices** are able to interact and communicate with each other. This means that certain modules being implemented in the two NFC Forum Devices are interoperable.

Table 3 defines the interoperability between the modules in a matrix. No interoperability is defined for the grey colored fields.

NOTE   Type 1 Tag and Type 2 Tag are not emulated on a device.

Table 3: Modules - Interoperability

Modules	Reader/ Writer	Initiator	Target	Type 3 Tag Platform	Type 4A Tag Platform	Type 4B Tag Platform
Reader/ Writer				X	X	X
Initiator			X			
Target		X				
Type 3 Tag Platform	X					
Type 4A Tag Platform	X					
Type 4B Tag Platform	X					

4.3   Requirements to Modules Mapping

This section maps in Table 4 the defined individual requirements to the NFC Forum interoperability modules.

Table 4: NFC Forum Interoperability Modules

Number			Relation	Reader/Writer	Initiator	Target	Type 3 Tag Platform	Type 4A Tag Platform	Type 4B Tag Platform	Comment
REQ										
REQ-1.A					M	M				P2P
REQ-1.B				M						R/W
REQ-1.C							C	C	C	Card Emulation
REQ-2.A				M	M					Poll Mode
REQ-2.B						M	C	C	C	Listen Mode
REQ-3.A				M						Detect is part of Profile definitions. Detect an NFC Forum Tag
REQ-3.B					M					Detect an NFC Forum Device
	REQ-3.1A			M						5 seconds NFC Forum Tag detection
	REQ-3.1.B				M					5 seconds NFC Forum Device detection
REQ-4.A				M	M					Technology Detection Activity NFC-A Poll
REQ-4.B				M						NFC-B Poll
REQ-4.C				M	M					NFC-F Poll
REQ-5			RF	M	M	M	C	C	C	

Number			Relation	Reader/Writer	Initiator	Target	Type 3 Tag Platform	Type 4A Tag Platform	Type 4B Tag Platform	Comment
REQ-6				M	M					Combination of Technology Detection & Collision Resolution Activities
REQ-7				M	M	M				
REQ-8				M	M	M				
REQ-9.A				M						RATS
REQ-9.A								C		ATS
REQ-9.B				M						ALLB_REQ, SENSB_REQ, ATTRIB
REQ-9.B									C	SENSB_RES
REQ-**RF**										
REQ-**RF-1**				M	M	M	C	C	C	
REQ-**P2P**										
REQ-**P2P-1**			P2P-1.1 P2P-1.2		M	M				Combination of Technology Detection & Collision Resolution Activities
	REQ-**P2P-1.1**				M					
	REQ-**P2P-1.2**					M				
	REQ-**P2P-1.3**				M	M				
REQ-**P2P-2**			P2P-2.1 P2P-2.2		M	M				
	REQ-**P2P-2.1**				M	M				
	REQ-**P2P-2.2**				M	M				
REQ-**P2P-3**			P2P-3.1		M	M				
	REQ-**P2P-3.1**				M	M				
REQ-**RW**										
REQ-**RW-1**			RW-1.1 RW-1.2 RW-1.3 RW-1.4	M						Combination of Technology Detection & Collision Resolution Activities

Number			Relation	Reader/Writer	Initiator	Target	Type 3 Tag Platform	Type 4A Tag Platform	Type 4B Tag Platform	Comment
REQ-**RW-1.1**				M						
REQ-**RW-1.2**				M						
REQ-**RW-1.3**				M						
	RW-1.3.1			M						
REQ-**RW-1.4**				M						
	RW-1.4.1			M						
	RW-1.4.2			M						
REQ-**RW-2**			RW-2.1 RW-2.2 RW-2.3 RW-2.4	M						Combination of Technology Detection & Collision Resolution Activities
	REQ-**RW-2.1**			M						
	REQ-**RW-2.2**			M						
	REQ-**RW-2.3**			M						
		REQ-**RW-2.3.1**		M						
	REQ-**RW-2.4**			M						
		REQ-**RW-2.4.1**		M						
		REQ-**RW-2.4.2**		M						
REQ-**CE**										
REQ-**CE-1.A**			REQ-CE- 1.1 REQ-CE-1.2 REQ-CE-1.3					C		Entrance to state machine.
REQ-**CE-1.B**									C	

Number			Relation	Reader/Writer	Initiator	Target	Type 3 Tag Platform	Type 4A Tag Platform	Type 4B Tag Platform	Comment
REQ-**CE-1.C**							C			
	REQ-**CE-1.1**							C		
	REQ-**CE-1.2**								C	
	REQ-**CE-1.3**						C			
REQ-**TST**										
REQ-**TST-1.A**				M						Certification testing requirements, see [DTA] R/W
REQ-**TST-1.B**					M					P2P Poll
REQ-**TST-1.C**						M				P2P Listen
REQ-**TST-1.D**							C			T3T Listen
REQ-**TST-1.E**								C	C	T4T Listen

5 NFC Forum Requirements

The NFC Forum Device requirements are listed in the following sections:

- Requirements Terms (see Table 5): Defines capabilities of NFC-Forum-compliant devices.

- RF Requirements (see Table 6): Defines common performance requirements (for example, Operating Volume).

- Requirements for NFC Forum Peer Mode (see Table 7): Defines in detail the capabilities of NFC-Forum-compliant devices in NFC Forum Peer Mode.

- Requirements for NFC Forum Reader/Writer Mode (see Table 8): Defines in detail the capabilities of NFC–Forum-compliant devices in NFC Forum Reader/Writer Mode.

- Requirements for NFC Forum Card Emulation Module (see Table 9): Defines in detail the capabilities of NFC-Forum Devices in NFC Forum Card Emulation Mode.

- Requirements for NFC Forum Certification (see Table 10): Defines requirements required for certification of NFC Forum Devices.

5.1 Requirements Terms

Table 5: Requirements Terms

No.	Requirements Terms	Remark
REQ-1.A	The ability to communicate in Peer Mode.	See Sections 5.3.
REQ-1.B	The ability to communicate in NFC Forum Reader/Writer Mode.	See Section 5.4.
REQ-1.C	The ability to communicate in NFC Forum Card Emulation Mode.	See Section 5.5.
REQ-2.A	The ability to operate in Poll Mode.	
REQ-2.B	The ability to operate in Listen Mode.	
REQ-3.A	The ability to detect any NFC Forum Tag (potentially containing an NDEF message).	
REQ-3.B	The ability to detect an NFC Forum Device.	
REQ-3.1.A	The ability in Poll Mode to detect an NFC Forum Tag within 5 seconds when the tag or device is brought into the Operating Volume.	This is not a requirement to force a device to always poll, but if the device is polling, this requirement applies. This requirement applies to the digital protocol layer and defines an upper limit to detect a Tag
REQ-3.1.B	The ability in Poll Mode to detect an NFC Forum Device in Peer Mode within 5 seconds of the device being brought into the Operating Volume.	This is not a requirement to force a device to always poll, but if the device is polling, this requirement applies. This requirement applies to the digital protocol layer and defines an upper limit to detect a Peer device.
REQ-4.A	The ability to poll for technology—NFC-A.	
REQ-4.B	The ability to poll for technology—NFC-B.	
REQ-4.C	The ability to poll for technology—NFC-F.	
REQ-5	The ability to achieve a minimum operating range.	See Section 5.2.

No.	Requirements Terms	Remark
REQ-6	The ability to detect if multiple NFC Forum Devices and/or NFC Forum Tags respond to a poll command. There is no requirement to identify each responding device.	
REQ-7	The ability to generate NDEF data as defined by [NDEF].	
REQ-8	The ability to accept any NDEF message formatted according to [NDEF].	If the NDEF data is not meaningful (content or size-wise), the NFC Forum device will either ignore it or generate some kind of error message. The error message to the user should indicate that the information is meaningless to the application (for example, "not valid content").
REQ-9.A	In NFC-A, the ability to set the parameters to disable the support of advanced protocol features, as follows: • In the RATS command, the ability to set FSDI equal to 8h. • In response to the RATS command, the ability to set the following to 0b: • Bits b7 to b5 and b3 to b1 of TA(1)	

REQ-9.B	In NFC-B, the ability to set the parameters to disable the support of advanced protocol features, as follows:
	• In the ALLB_REQ and SENSB_REQ commands, the ability to set bit b5 of PARAM to 0b.
	• in the SENSB_RES response, the ability to set the following to 0b:
	  • Bits b7 to b5 and b3 to b1 of the Bit_Rate_Capability field
	  • Bits b3 and b2 of the Protocol_Type field
	• In the ATTRIB command, the ability to set bits b8 to b3 of Param 1 to 0b.	

5.2   RF Requirements

Table 6: RF Requirements

RF No.	RF Requirement	Remark
REQ-RF-1	The ability to exchange data with another compliant NFC Forum Device within the Operating Volume as defined in [ANALOG].	

5.3   Requirements for NFC Forum Peer Mode

Table 7: Requirements for NFC Forum Peer Mode

REQ-P2P No.	P2P Requirement	Remark
REQ-P2P-1	In Peer Mode, the ability to communicate with another device in Peer Mode to exchange data.	
REQ-P2P-1.1	In Peer Mode, the ability to exchange data as initiator in passive communication mode using at least one of the following bit rates: 106, 212, or 424 kbit/s.	
REQ-P2P-1.2	In Peer Mode, the ability to exchange data as the target in passive communication mode at 106, 212, and 424 kbit/s.	
REQ-P2P-1.3	In Peer Mode, the ability to support payload sizes up to and including 254 bytes.	The definition of payload is according to NFC-DEP Protocol as defined in [DIGITAL].
REQ-P2P-2	In Peer Mode, the ability to support LLCP as defined in [LLCP].	
REQ-P2P-2.1	In Peer Mode, the ability to support LLCP link service class 3 as defined in [LLCP].	
REQ-P2P-2.2	In Peer Mode, the ability to support protocol bindings for NFC Forum Registered Protocols (LLCP or SNEP or both).	
REQ-P2P-3	In Peer Mode, the ability to communicate with another device in Peer Mode to exchange NDEF Data as defined in [SNEP].	
REQ-P2P-3.1	In Peer Mode, the ability to support a Default SNEP Server as defined in [SNEP].	

5.4   Requirements for NFC Forum Reader/Writer Mode

Table 8: Requirements for NFC Forum Reader/Writer Mode

REQ-RW No.	Reader/Writer Mode Requirement	Remark
REQ-RW-1	The ability to read NDEF data structures from all NFC Forum Tag Types when a single tag is present in the Operating Volume.	
REQ-RW-1.1	The ability to read NDEF data structures of an NFC Forum Type 1 Tag.	
REQ-RW-1.2	The ability to read NDEF data structures of an NFC Forum Type 2 Tag.	
REQ-RW-1.3	The ability to read NDEF data structures of an NFC Forum Type 3 Tag.	
REQ-RW-1.3.1	The ability to read payload sizes up to 254 bytes at a bit rate of at least 212 kbit/s from a NFC Forum Type 3 Tag. The definition of payload is according to [DIGITAL] for Type 3 Tag Platform.	
REQ-RW-1.4	The ability to read NDEF data structures of an NFC Forum Type 4 Tag.	
REQ-RW-1.4.1	Reading an NFC Forum Type 4 Tag, the ability to support a payload size of 254 bytes, and a bit rate of 106 kbit/s. The definition of payload is used in accordance with [DIGITAL].	
REQ-RW-1.4.2	Reading an NFC Forum Type 4 Tag, the ability to support 256 data bytes within the response APDU. The definition of data bytes is used in accordance with [T4TOP].	256 bytes is the maximum amount of data that can be read by a command APDU.
REQ-RW-2	The ability to write NDEF data structures to all NFC Forum Tag Types when a single tag is present in the Operating Volume.	
REQ-RW-2.1	The ability to write NDEF data structures to an NFC Forum Type 1 Tag.	
REQ-RW-2.2	The ability to write NDEF data structures to an NFC Forum Type 2 Tag.	

REQ-RW No.	Reader/Writer Mode Requirement	Remark
REQ-RW-2.3	The ability to write NDEF data structures to an NFC Forum Type 3 Tag.	
REQ-RW-2.3.1	Writing NDEF data to an NFC Forum Type 3 Tag, the ability to support payload sizes up to 254 bytes and SHALL support a bit rate of at least 212 kbit/s. The definition of payload is according to [DIGITAL] for Type 3 Tag Platform.	
REQ-RW-2.4	The ability to write NDEF data structures to an NFC Forum Type 4 Tag.	
REQ-RW-2.4.1	Writing NDEF data to an NFC Forum Type 4 Tag, the ability to support a payload size of 254 bytes, and a bit rate of 106 kbit/s. The definition of payload is used in accordance with [DIGITAL].	
REQ-RW-2.4.2	Writing NDEF data to an NFC Forum Type 4 Tag, the ability to support 255 data bytes within the command APDU. The definition of data bytes is used in accordance with [T4TOP].	255 bytes is the maximum amount of data that can be written by a command APDU.

5.5   Requirements for NFC Forum Card Emulation Module

Table 9: Requirements for NFC Forum Card Emulation Mode

CE No.	Card Emulation Mode Requirement	Remarks
REQ-CE-1.A	The ability to support NFC-A in listen mode.	
REQ-CE-1.B	The ability to support NFC-B in listen mode.	
REQ-CE-1.C	The ability to support NFC-F in listen mode.	
REQ-CE-1.1	Compliant to the Type 4A Tag Platform as per [DIGITAL] and [ACTIVITY].	
REQ-CE-1.2	Compliant to the Type 4B Tag Platform as per [DIGITAL] and [ACTIVITY].	
REQ-CE-1.3	Compliant to the Type 3 Tag Platform as per [DIGITAL] and [ACTIVITY].	

NOTE   In NFC Forum Card Emulation Mode, no requirements are specified for tag emulation to exchange NDEF data between NFC Forum Devices.

5.6 Requirements for NFC Forum Certification

Table 10: Test Requirements

REQ-TST No.	Test Requirement	Remark
REQ-TST-1.A	Implementation of the Device Test Application for Reader/Writer mode as defined in [DTA] for use during NFC Forum certification testing.	The management of the presence and visibility of the DTA during the lifetime of the NFC Forum Device besides NFC Forum certification testing is out of scope.
REQ-TST-1.B	Implementation of the Device Test Application for Initiator as defined in [DTA] for use during NFC Forum certification testing.	In DTA Initiator is referred to Poll mode. The management of the presence and visibility of the DTA during the lifetime of the NFC Forum Device besides NFC Forum certification testing is out of scope.
REQ-TST-1.C	Implementation of the Device Test Application for Target as defined in [DTA] for use during NFC Forum certification testing.	In DTA Target is referred to Listen mode. The management of the presence and visibility of the DTA during the lifetime of the NFC Forum Device besides NFC Forum certification testing is out of scope.
REQ-TST-1.D	Implementation of the Device Test Application for Type 3 Tag Platform Listen mode as defined in [DTA] for use during NFC Forum certification testing.	The management of the presence and visibility of the DTA during the lifetime of the NFC Forum Device besides NFC Forum certification testing is out of scope.
REQ-TST-1.E	Implementation of the Device Test Application for Type 4 Tag Platform Listen mode as defined in [DTA] for use during NFC Forum certification testing.	The management of the presence and visibility of the DTA during the lifetime of the NFC Forum Device besides NFC Forum certification testing is out of scope.

A. Requirements and Technical Specifications Cross Reference (Informative)

Table 11 shows the cross references between the requirements in this document and the relevant set of NFC Forum Technical Specifications.

Table 11: Cross Reference

Number			Relation	ANALOG	ACTIVITY	DIG PROT	LLCP	SNEP	NDEF	TxT OP	Comment
REQ											
REQ-1			P2P RW CE (Opt.)	X	X	X					
REQ-2					X						Device must be able to switch between modes. RF Collision Avoidance.
REQ-3					X						Detect is part of Profile definitions.
	REQ-3.1										
REQ-4					X	X					Technology Detection Activity
REQ-5			RF								
REQ-6					X						Combination of Technology Detection & Collision Resolution Activities
REQ-7									X		
REQ-8									X		
RF											
REQ-RF-1				X							
P2P											
REQ-P2P-1			REQ-P2P-1.1 REQ-P2P-1.2		X						Combination of Technology Detection & Collision Resolution Activities
	REQ-P2P-1.1					X					
	REQ-P2P-1.2				X	X					
	REQ-P2P-1.3					X					

Number			Relation	ANALOG	ACTIVITY	DIG PROT	LLCP	SNEP	NDEF	TxT OP	Comment
REQ-P2P-2			REQ-P2P-2.1 REQ-P2P-2.2				X				
	REQ-P2P-2.1						X				
	REQ-P2P-2.2						X				
REQ-P2P-3			REQ-P2P-3.1					X			
	REQ-P2P-3.1							X			
RW											
REQ-RW-1			REQ-RW-1.1 REQ-RW-1.2 REQ-RW-1.3 REQ-RW-1.4		X						Combination of Technology Detection & Collision Resolution Activities
	REQ-RW-1.1					X				X	
	REQ-RW-1.2					X				X	
	REQ-RW-1.3					X				X	
		REQ-RW-1.3.1				X				X	
	REQ-RW-1.4					X				X	
		REQ-RW-1.4.1				X					
		REQ-RW-1.4.2								X	
REQ-RW-2			REQ-RW-2.1 REQ-RW-2.2 REQ-RW-2.3 REQ-RW-2.4		X						Combination of Technology Detection & Collision Resolution Activities
	REQ-RW-2.1					X				X	
	REQ-RW-2.2					X				X	
	REQ-RW-2.3					X				X	
		REQ-RW-2.3.1				X				X	

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Number			Relation	ANALOG	ACTIVITY	DIG PROT	LLCP	SNEP	NDEF	TxT OP	Comment
	REQ-RW-2.4					X				X	
		REQ-RW-2.4.1				X					
		REQ-RW-2.4.2								X	
CE											
REQ-CE-1			REQ-CE-1.1 REQ-CE-1.2 REQ-CE-1.3		X						Entrance to state machine.
	REQ-CE-1.1				X	X					
	REQ-CE-1.2				X	X					
	REQ-CE-1.3				X	X					
TST											
REQ-TST-1											Certification testing requirements, see [DTA]

B. Use Cases (Informative)

Two broad categories of use cases were considered in identifying the requirements:

- Those in which the communication protocols are wholly defined by the NFC Forum

- Those in which an NFC Forum Device communicates with another device using compatible legacy protocols

The use cases are described in the sections below and illustrated in the accompanying figures.

Figure 1 describes the conventions used in the figures below to indicate the roles of the different actors in the use cases. This usage is confined to the illustrations of the use cases in this document and does not indicate the general usage of the marks.
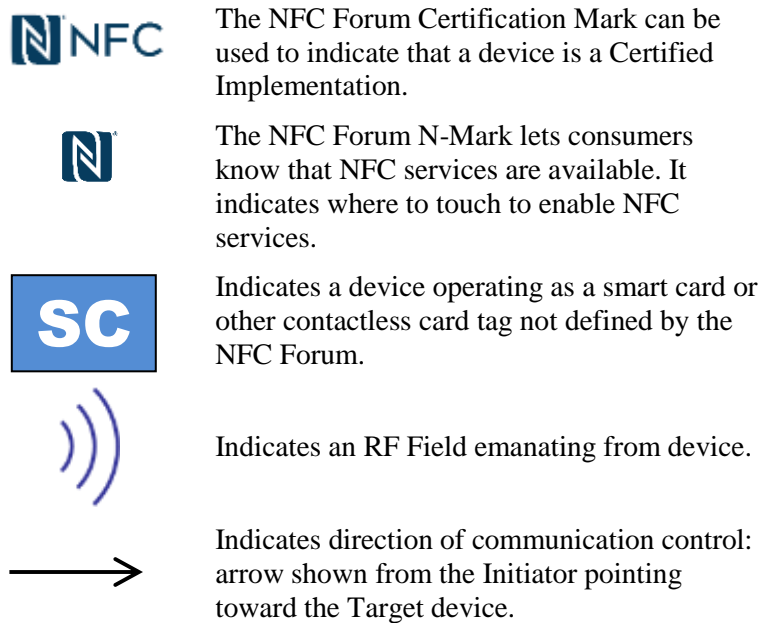
NFC	The NFC Forum Certification Mark can be used to indicate that a device is a Certified Implementation.
N	The NFC Forum N-Mark lets consumers know that NFC services are available. It indicates where to touch to enable NFC services.
SC	Indicates a device operating as a smart card or other contactless card tag not defined by the NFC Forum.
)))	Indicates an RF Field emanating from device.
→	Indicates direction of communication control: arrow shown from the Initiator pointing toward the Target device.

Figure 1: Conventions for Use Case Diagrams

B.1 NFC Forum Communication Use Cases

The use cases defined in this section deal with communication between an NFC Forum Device and another actor as defined below. Interoperability up to a certain level is ensured by the NFC Forum Certification Program.

1. An NFC Forum Device is able to communicate with another NFC Forum Device in NFC Forum Peer Mode. This is illustrated in Figure 2.
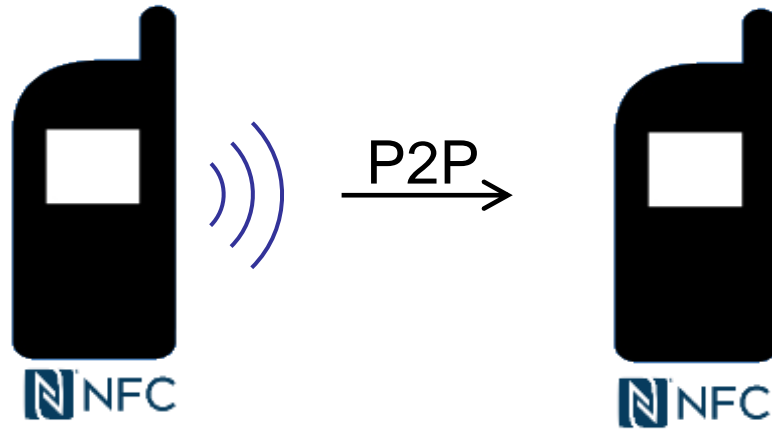
Figure 2: Two NFC Forum Devices Communicating in NFC Forum Peer Mode

2. An NFC Forum Device in NFC Forum Reader/Writer Mode is able to communicate with an external NFC Forum Tag. The NFC Forum Tags were specified by the NFC Forum and specifications on how to operate these tags have been made available. This is illustrated in Figure 3.
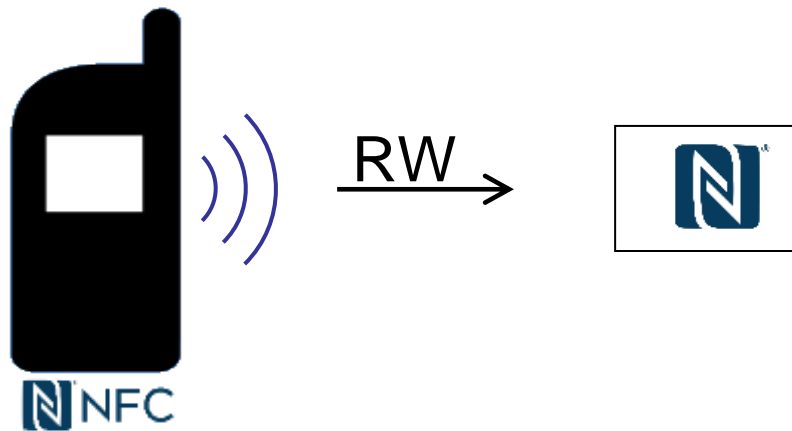

Figure 3: NFC Forum Device in NFC Forum Reader/Writer Mode Communicating with an NFC Forum Tag

3. An NFC Forum Device in NFC Forum Reader/Writer Mode is able to communicate with an NFC Forum Device emulating an NFC Forum Tag. This is illustrated in Figure 4.

Figure 4: NFC Forum Device in NFC Forum Reader/Writer Mode Communicating with an NFC Forum Device in NFC Forum Card Emulation Mode

B.2 Legacy Communication Use Cases

The use cases defined in this section deal with communication between an NFC Forum Device and legacy systems that are not defined by the NFC Forum. However, parts of the implementation of an NFC Forum Device, like the RF layer or lower layer protocols, are also used by legacy infrastructure. The NFC Forum takes into account that requirements for some parts of the protocol stack may impact the usability of NFC Forum Devices within existing contactless infrastructure, and therefore NFC Forum takes requirements of legacy systems into consideration when testing parts of the protocol stack that are also relevant for legacy systems.

An NFC Forum Device in Reader/Writer mode can communicate to an external smart card (or other contactless card or tag) that is supporting applications and protocols defined outside the NFC Forum. The smart card system is based on one of the technologies (ISO/IEC 14443A, ISO/IEC 14443B, and/or JIS X 6319-4) compatible with those defined by the NFC Forum (NFC-A, NFC-B, and/or NFC-F). This is illustrated in Figure 5.
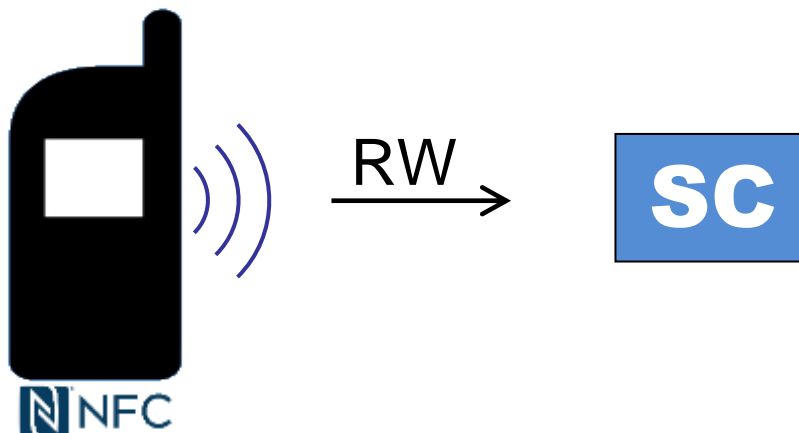

Figure 5: NFC Forum Device in NFC Forum Reader/Writer Mode Communicating with a SC

4. An NFC Forum Device in Reader/Writer mode can communicate with another NFC Forum Device emulating a smart card (or other contactless card or tag) that supports applications and

protocols defined outside of the NFC Forum. The smart card system is based on a technology defined by the NFC Forum (NFC-A, NFC-B, and/or NFC-F). This is illustrated in Figure 6.
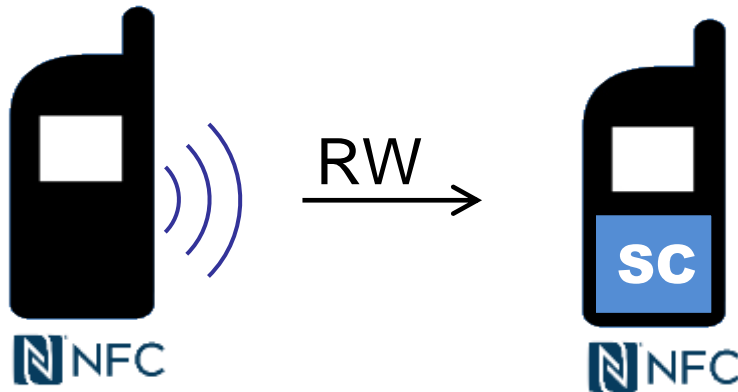

Figure 6: NFC Forum Device in NFC Forum Reader/Writer Mode Communicating with an NFC Forum Device Emulating an SC

5. An NFC Forum Device emulating a smart card (or other contactless card or tag) can be accessed by an external reader/writer terminal. The smart card system is based on one of the technologies (ISO/IEC 14443A, ISO/IEC 14443B, and/or JIS X 6319-4) compatible with those defined by the NFC Forum (NFC-A, NFC-B, and/or NFC-F). This is illustrated in Figure 7.
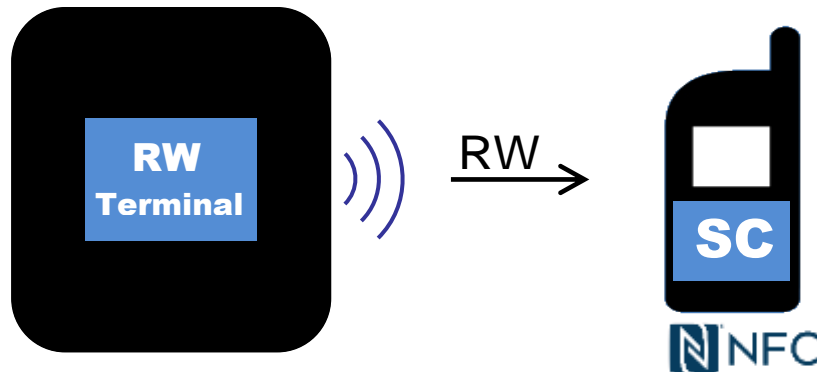

Figure 7: Reader/Writer Terminal and NFC Forum Device Emulating an SC

C.   NFC Forum Architecture (Informative)

A detailed description of the NFC Forum Arcitecture can be found [ARCHITECTURE]. The intention of the document describing the NFC Forum Architecture is to assist in understanding the aspects of an NFC Forum Device that are in the scope of, and specified by, the NFC Forum.

D. Revision History

The following table outlines the revision history of the Device Requirements document.

Table 12: Revision History

Document Name	Revision and Release Date	Status	Change Notice	Supersedes
Device Requirements	Version 1.0, October 2010	Release Version	First release	-
Device Requirements	Version 1.1, 30 May 2012	Release Version	Update references to latest available NFC Forum specifications, add clarification on specific specification versions listed, updated figure of NFC Forum Card Emulation Mode, added more precise requirements for the NFC Forum Peer Mode, NFC Forum N-Mark related text update, applied some minor text clarifications	Version 1.0, October 2010
Device Requirements	Version 1.2, 19 July 2012	Release Version	Removed Section 1.3 with the Interim Exceptions; Added the applicable version for Analog; Added the reference to the RTD; Other minor editorial corrections.	Version 1.1, 30 May 2011
Device Requirements	Version 1.3, xx March 2013	Final Draft Version	Added requirement for the support of the DTA	Version 1.2, 19 July 2012
NFC Forum Device Requirement	Version 1.4, July. 2015	Draft 1	- restructuring of document to enable the option for addition of further device classes - Update of high level reqs. according to TC feedback - remove section on NFC Forum Architecture and instead reference to Architecture white paper	
NFC Forum Device Requirements	Version 1.4.01 March 2016	Final	Standard size logo on each page. Standardized front page format. Adjusted a number of misaligned logos in the figures. Note: when row sizes were adjusted in Table 10, several inline comments showed up in column 3. New Word section for appendices.	Version 1.4.01 Feb 2016
NFC Forum Device Requirements	Version 1.5.01 September 2016	Final	Update to incorporate ANALOG v2.0 for TR 2016	Version 1.4.01 March 2016
NFC Forum Device Requirements	Version 1.5.02 February 2017	Final	Added [ARCHITECTURE] in section 1.4. Changed http link in Appendix C	Version 1.5.01 September 2016